

# Active Vibration Isolation System for Mobile Launch Platform Ground Support Equipment, Phase I

Completed Technology Project (2008 - 2009)



## Project Introduction

Balcones Technologies, proposes to adapt actively controlled suspension technology developed for high performance off-road vehicles to address NASA's requirement for Active Vibration Control for Ground Support Equipment (GSE). This innovative approach to meeting NASA needs exploits approximately \$23M of highly successful R&D since 1993 at the University of Texas Center for Electromechanics (CEM) on active suspension systems for off-road military vehicles. STTR subtopic T6.02 indicates that previous experience on NASA's Mobile Launch Platform (MLP) shows that passive vibration isolation systems are inadequate and that actively controlled vibration isolation systems to supplement or replace existing passive systems will most likely be required. Initial modeling of this system by CEM indicates that our team's proposed actively controlled Vibration Isolation System (VIS) provides more than an order of magnitude improvement in vibration isolation compared to conventional approaches (see proposal Part 4 for details). Our actively controlled VIS offers unique benefits compared to conventional passive systems because it mimics compliant attachment to inertial reference systems rather than attachment to local reference systems on the vibrating MLP; eliminates resonant peaks associated with passive systems (i.e., our system has flat response at low frequencies); and provides 10 to 16 times better vibration isolation over most of the frequency range of interest than conventional systems. Based on our vehicular active suspension results and preliminary modeling described in proposal Part 4, our proven design approach will yield robust solutions that are not sensitive to variations in GSE electronics racks or MLP excitations during shuttle launch. This approach fully meets all requirements defined or implied in STTR 2007-1 Subtopic T6.02.

## Anticipated Benefits

Potential NASA Commercial Applications: Our active VIS system and the general VIS technology being designed for the Mobile Launch Platform will be useful to a variety of non-NASA applications, either directly or through scaling of components. Our system will likely utilize many components similar to those being developed for military vehicles and will benefit from ongoing commercialization efforts in that area to reduce costs and increase life. In addition to the MLP application, our active VIS technology will be applicable for vibration isolation for any sensitive payloads in harsh vibrational environments. Some immediately apparent non-NASA applications include military applications that parallel the NASA applications described above, sensitive equipment in earthquake prone areas, sensitive equipment during transport, vibration isolation of sensitive manufacturing processes and highly sensitive instrumentation or scientific equipment in normal environments. Early applications will favor high value or specialized payloads, but as markets grow and reduced costs become possible, the range of applicable payloads will grow.



Active Vibration Isolation System for Mobile Launch Platform Ground Support Equipment, Phase I

## Table of Contents

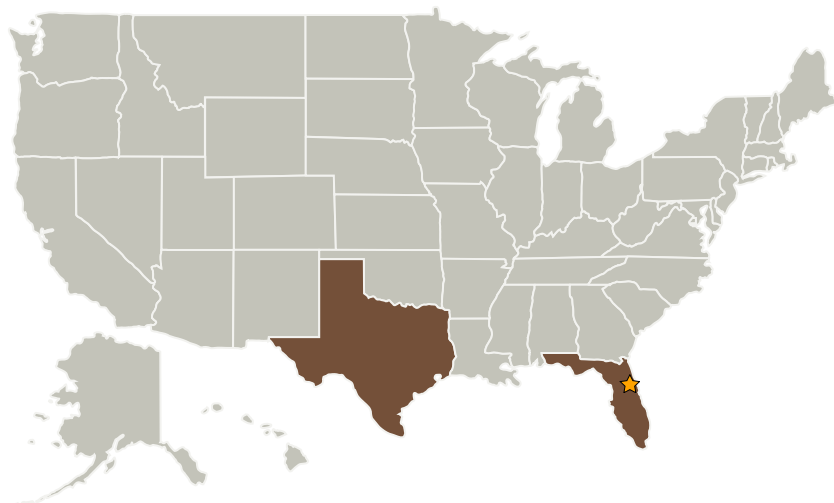
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3

## Active Vibration Isolation System for Mobile Launch Platform Ground Support Equipment, Phase I

Completed Technology Project (2008 - 2009)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Balcones Technologies, LLC	Supporting Organization	Industry	Austin, Texas
University of Texas - Center for Electromechanics	Supporting Organization	Academia	Austin, Texas

Primary U.S. Work Locations	
Florida	Texas

## Project Transitions

**February 2008:** Project Start

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Kennedy Space Center (KSC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

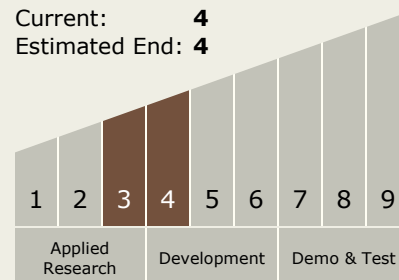
Carlos Torrez

**Principal Investigator:**

Joseph Beno

## Technology Maturity (TRL)

Start: **3**  
 Current: **4**  
 Estimated End: **4**



# Active Vibration Isolation System for Mobile Launch Platform Ground Support Equipment, Phase I

Completed Technology Project (2008 - 2009)



**February 2009:** Closed out

**Closeout Summary:** Active Vibration Isolation System for Mobile Launch Platform Ground Support Equipment, Phase I Project Image

## Technology Areas

### Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.5 Revolutionary Communications Technologies
    - └ TX05.5.3 Hybrid Radio and Optical Technologies